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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ZERVIGON, RUDY	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 09/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/039,438	SHIN ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 2, 2004 has been entered.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat. 4,147,581) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838). Nelson discloses an etching process and apparatus for chemically etching[1] (reduction in thickness) material from a substrate (column 1, lines 40-68; Figure 1). An etched product ("solid"; column 4, lines 40-50) is etched in unit 2 (Applicant's "first tank" Figure 1) thereby at least contacting the solid with the aqueous liquid (first etchant – "etching solution"; column 4, line 43; column 2, lines 45-69) including HF (abstract) and the resulting liquid (residual etchant of stream 3, Figure 1; column 4, lines 58-60) is passed through an ion exchanger (11, Figure 1; "separation tank"; column 4, line 67-column 5, line 16) to remove the ions from the rinse liquid which is reused or discharged (30, 16; Figure 1). The solids (residue materials) are removed from

an etcher ("etch bath") (2) via a stream (3) which passes into a rinse chamber (a second tank; 4; Fig. 1; col. 4, lines 49-68) including outlet pipe (6; column 4, lines 55-57). The rinse liquid stream (7) then goes through an ion exchanger means (11). A replenishing solution (30) from the ion exchange means is combined (31) with the stream (22) of a bulk storage tank (20; 1st Tank; column 5, lines 35-40) to form a combined stream (31) going to the etcher (2; col. 5, lines 35-55). The bulk storage tank (20) has streams flowing to the etcher (2) for etching the product and to the ion exchange means (11) in order to regenerate the resin. Stream (12) from the ion exchanger (11) moves to a discharge stream (16), which passes to a sewer. (Col. 5, lines 5-10). The etcher (2) can be a spray etcher which would inherently have nozzles (col. 4, line 40).

Nelson does not disclose an immersion of a substrate in an etched bath or a bubble plate used therein.

Chung et al disclose a bubble plate (17) located on the floor of a tank (10; Fig. 1). The bubble plate (17) transmits inert gas to create a bubbling condition within the tank (10) for sufficient agitation (col. 1, lines 60-68). Silicon substrates (14; column 3, lines 44-48) are immersed in an etch bath ("hot sulfuric acid"; 13; Fig. 2; col. 2, lines 25-38; column 3, lines 44-48).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to replace the spray etcher of Nelson with the etch bath and bubble plate of Chung et al.

The motivation for doing so would be to replace the etchant delivery means (ie, sparger etcher) with an alternate and equivalent etching means (ie a bath etcher).

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[1] Etch – 1a: to produce (as a pattern or design) on a hard material by eating into the material's surface (as by acid or

Nelson and Chung et al do not teach a temperature sensor and control unit.

Kanda et al disclose a process control system (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) having a thermocouple for measuring the temperature of the etching solution (8, Figure 2; column 9, lines 22-23) used to etch a submerged substrate (2, Figure 3). Kanda specifically teaches a control unit (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) for receiving a signal indicating the temperature (T) of the etchant from a temperature sensor ("thermocouple") and transmitting an etching termination signal ($P \simeq 0$) to the etch bath when the temperature reaches a target temperature. Further, Kanda teaches the etched thickness (Q; column 10, lines 10-15) of the substrate is derived from the temperature (T) of the first etchant.

Nelson, Chung, and Kanda do not teach using the total reaction energy as a reference. Nelson, Chung, and Kanda do not teach a controller that controls the first tank, the etch bath and the second tank. Nelson, Chung, and Kanda do not teach using gravity (i.e. weight) for separating the diluted etchant from the residual material.

Allies teaches a controller (340; Figure 3; column 3, lines 55-60) that controls the volume of fluid within numerous process tanks (column 3, lines 58-67), including controlling the temperature of said tank(s) (column 3, lines 58-67) resulting from numerous input signals (column 4, lines 1-10). Allies further teaches teach using gravity (i.e. weight) for separating the etchant ($CuCl_2$ etchant – column 3, lines 37-40) from residual material by mass/material filtration in filtration tank 338, Figure 3 – column 5, line 64 - column 6, line 5

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laser beam). Merriam-Webster's Collegiate Dictionary - 10th Ed. p.398

At the time of the invention it would have been obvious to a person of ordinary skill in the art to control the etching operation for the etching apparatus of Nelson with the chemical processing control system of Kanda and Allies including using the total reaction energy as a reference by replacing Kanda's temperature in any of Kanda's "Q" equations (column 10) with "reaction energy" as derived from the well know thermodynamic relationship between molar enthalpy (per unit mass), heat capacity, and temperature[2]:

$$\frac{\partial H}{\partial T} \equiv c_p$$

The motivation for controlling the etching operation for the etching apparatus of Nelson and Chung et al with the chemical processing control system of Kanda and Allies, using "reaction energy", would have been to detect the termination of etching appropriately and precisely as taught by Kanda (column 10, lines 44-47) by an alternate a equivalent means of detecting said termination in using "reaction energy".

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add Allies's mass/material separation filtration tank to Nelson's processing system.

The motivation to add Allies's mass/material separation filtration tank to Nelson's processing system is to further purifying the recycled spent etchant solution as taught by Allies (column 5, line 64 - column 6, line 5).

Therefore, it would have been obvious to a person of ordinary skill in the art to combine Nelson with Chung et al and Kanda to obtain the invention.

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[2] As demonstrated (MPEP 2116.01) in Physics for Scientists & Engineers, 2nd Ed. R.A. Serway, Saunders College Publishing, 1986. pp. 428 (see top-most equation).

4. Claims 3-6, 8, 9, 12, 15, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat.4,147,581) in view of Chung et al (U.S.Pat.5,00,795), Kanda (U.S. Pat. No. 4,886,590), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Jones et al (U.S. Pat. No. 3,869,313).

Nelson, Chung, Kanda, and Allies are discussed above.

Nelson, Chung, Kanda, and Allies do not disclose expressly a rinse and drying bath for the substrate.

As to claims 3-5, 8, 9, and 12, Jones et al disclose a chemical processing apparatus containing a plurality of treatment chambers having a dip chamber with filling pumps, a spray chamber which serves as a rinse chamber or a drying chamber (col. 2, lines 20-39 and 63-68; col. 3, lines 1-10). The rinse chamber would be filled with deionized water from a deionized reservoir (col. 2, lines 52-55). An essential part of the apparatus is a conveyor means for automatically transferring the workpieces from treatment chamber to treatment chamber. (Fig. 1; Col. 3, lines 50-55). The conveyor allows for a plurality of substrates to be processed substantially at the same time. Using a pump to move fluid from one chamber to another is conventional. Jones further teaches a "controlled heater 67" (column 2, lines 28-35) used in the "treatment" chamber that "may be used as a drying chamber" (column 3, lines 1-3).

As to claim 6, Jones et al disclose a cleaning/etching solution containing hydrofluoric acid (col. 5, lines 49-60; col. 6, lines 33-35 and 51-54). Jones et al disclose cone shaped bottom tanks (Figs. 6A-B).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the multiple chambers for rinsing and drying of Jones et al with the etching apparatus of Nelson, Chung et al, and Kanda.

The motivation for doing so would have been to provide treating operations such as rinsing and drying of substrates as taught by Jones et al.

5. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat. 4,147,581) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Tittle (USPat. 4,886,590). Nelson, Chung, Kanda, and Allies are discussed above. However, Nelson, Chung, Kanda, and Allies do not teach a concentration measuring device of the first etchant.

Tittle teaches a concentration ("characteristic"; column 1, lines 31-36; column 2, lines 17-22) measuring device ("sensors", "chromatograph"; column 1, lines 65-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Nelson, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his endpoint detection system.

Motivation for Nelson, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his process control system is for monitoring when the rinsing solution should be changed or cleaned (column 1, lines 39-41).

Response to Arguments

6. Applicant's arguments filed June 2, 2004 have been fully considered but they are not persuasive.

7. Applicant states:

"

... claim 1 recites a combination of elements including, for example, "a second tank receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material; a connecting passage directly connecting the first and second tanks and directly transferring the separated diluted etchant from the second tank to the first tank; an outlet pipe attached to the second tank, the outlet pipe discharging the residue material.. ." None of the cited references, singly or in combination, teaches or suggests at least this feature ...

" Page 8 of the response.

In response, the Examiner has repeatedly cited Nelson (USPat. 4,147,581) as teaching Applicant's claimed elements of "a second tank (4; Figure 1) receiving the residual etchant (residual etchant of stream 3, Figure 1; column 4, lines 58-60) from the etch bath (solution contained by tank 2; Figure 1) and separating (11, Figure 1; "separation tank"; column 4, line 67-column 5, line 16) the diluted etchant from the residue material; a connecting passage (3; Figure 1) directly connecting the first (2) and second (4) tanks and directly transferring (piping 7, 8,30, 31; Figure 1) the separated diluted etchant from the second tank (4) to the first tank (2); an outlet pipe (6) attached to the second tank (4), the outlet pipe discharging the residue material.. ."

8. Applicant states that Nelson's "solids" (plural) as stated in column 4, lines 36-57 is Nelson's "solid" (singular) that Nelson etches in etch bath tank 2. Applicant is mischaracterizing the Nelson reference. In particular, the Examiner has noted Nelson's specific use of the plural form of "solid" with reference to materials in transit between tanks 2 and 3 as discussed by Nelson. Further, if Applicant's position were correct, then Nelson's solid in etch bath 2 would be

100% conveyed (i.e. destroyed) to tank 4 rendering Nelson's apparatus inoperative in its intended use.

9. Applicant states:

"

Unlike the instant application, there is no "target temperature" in Kanda, which is relative to an initial temperamre of the etchant, since the measured temperatures in Kanda are only used to compensate the differences of the etching rate at various temperatures to precisely determine the end point of the etching. See Kanda Col. 9,line 12 - Col. 10, line 47.

"

The Examiner disagrees. Kanda's equations and discussions along column 9, line 12 – column 10, line 47 specifically reference a target temperature " T' " as the temperature at which the etching solution consists of 85% phosphoric acid (column 9, lines 60-65). In particular, skilled routineers would be able to solve Kanda's "total etching thickness Q" equation (column 10, lines 5-15) for Kanda's target temperature T' given desired thickness Q and desired time M1.

10. Applicant states that none of the references teach:

"

a separation tank (11, Figure 1; "separation tank"; column 4, line 67-column 5, line 16) receiving (via pipe 7) the residual etchant (residual etchant of stream 3, Figure 1; column 4, lines 58-60) from the etch bath (contained by tank 2 and transferred to tank 4) and separating the diluted etchant from the residue material

"

In response, the Examiner has already asserted that Nelson, Chung, and Kanda do not teach using gravity (i.e. weight) for separating the diluted etchant from the residual material. However, Allies teaches a controller (340; Figure 3; column 3, lines 55-60) that controls the volume of fluid within numerous process tanks (column 3, lines 58-67), including controlling the temperature of said tank(s) (column 3, lines 58-67) resulting from numerous input signals (column 4, lines 1-10). Allies further teaches teach using gravity (i.e. weight) for separating the etchant ($CuCl_2$ etchant – column 3, lines 37-40) from residual material by mass/material filtration in filtration tank 338, Figure 3 – column 5, line 64 - column 6, line 5.

11. The remainder of Applicant's arguments simply assert that the particular references do not teach Applicant's claimed subject matter without particulaly pointing out the supposed errors in the Examiner's rejection and/or interpritation of the applied references. The Examiner maintains his positions and grounds for rejection of Applicant's pending claims.

12. The Examiner's 35 USC 112, 2nd paragraph rejections from the Final Rejection are withdrawn as a result of Applicant's amendment.

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272.1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be

directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (571) 272-1439.